

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

REC'D 06 JUN 2006

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference 2005P02667WO	FOR FURTHER ACTION	
	See Form PCT/IPEA/416	
International application No. PCT/EP2005/050804	International filing date (<i>day/month/year</i>) 25.02.2005	Priority date (<i>day/month/year</i>) 27.02.2004
International Patent Classification (IPC) or national classification and IPC INV. F01D5/18		
Applicant SIEMENS INDUSTRIAL TURBOMACHINERY A.B. et al		

<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> (<i>sent to the applicant and to the International Bureau</i>) a total of 5 sheets, as follows:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. <p>b. <input type="checkbox"/> (<i>sent to the International Bureau only</i>) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>
<p>4. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Box No. I Basis of the report <input type="checkbox"/> Box No. II Priority <input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability <input type="checkbox"/> Box No. IV Lack of unity of invention <input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement <input type="checkbox"/> Box No. VI Certain documents cited <input checked="" type="checkbox"/> Box No. VII Certain defects in the international application <input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application

Date of submission of the demand 12.12.2005	Date of completion of this report 06.06.2006
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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2005/050804

Box No. I Basis of the report

1. With regard to the **language**, this report is based on
 - the international application in the language in which it was filed
 - a translation of the international application into , which is the language of a translation furnished for the purposes of:
 - international search (under Rules 12.3(a) and 23.1(b))
 - publication of the international application (under Rule 12.4(a))
 - international preliminary examination (under Rules 55.2(a) and/or 55.3(a))
2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

1-16 as originally filed

Claims, Numbers

1-21 received on 12.12.2005 with letter of 05.12.2005

Drawings, Sheets

1/5-5/5 as originally filed

- a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

- The amendments have resulted in the cancellation of:
 - the description, pages
 - the claims, Nos.
 - the drawings, sheets/figs
 - the sequence listing (*specify*):
 - any table(s) related to sequence listing (*specify*):
- This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
 - the description, pages
 - the claims, Nos.
 - the drawings, sheets/figs
 - the sequence listing (*specify*):
 - any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2005/050804

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-21
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-21
Industrial applicability (IA)	Yes:	Claims	1-21
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/EP2005/050804

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

D1: US-B1-6 382 907
D2: SU 779 590
D3: RU-C1-2 042 833
D4: US-A-5 243 759
D5: US-A-3 017 159

2 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 does not involve an inventive step in the sense of Article 33(3) PCT.

2.1 Document D1 is regarded as being the closest prior art to the subject-matter of claim 1 and discloses (the references in parentheses applying to this document): a component defining a blade or a vane of a rotary machine comprising all the technical features of the preamble of said claim (see figs.1-4 and col. 3, l. 44 - col. 4, l. 51). It is evident from the disclosure of figs. 3 and 5 in particular that the first and second ribs (13',13'',14',14'') intersect at intersection joints in the proximity of the trailing edge in such a way that first and second channels form common outlet channels with a flow area.

The subject-matter of claim 1 therefore differs from this known component in that common outlet channel includes means for providing a reduction of the flow area in the proximity trailing end, wherein the first and second ribs have a main thickness (b) along their extension, wherein the first and second ribs (21,22) at the intersection joint (26) have a thickness being larger than the main thickness, thereby providing said reduction of the flow area of the common channels.

The problem to be solved by the present invention may therefore be regarded as increasing the cooling efficiency at the trailing edge and enhancing the mechanical

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.
PCT/EP2005/050804

strength of the component (see page 5, para 1).

The solution proposed in claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons. These features have already been employed for the same purpose in an identical component (see document D4, col. 3, lines 34-47). The circular restrictors (48 in D4) tune the cooling air flow rate in the trailing edge (see col. 2, l. 21-22) and their provision naturally also increases the stiffness of the otherwise rather thin structure of the trailing edge. These advantages are readily recognizable and predictable for the skilled person. It would therefore be obvious to the person skilled in the art, namely when the same result is to be achieved, to apply these features with corresponding effect to a component according to document D1, thereby arriving at a component according to claim 1.

Consequently the subject-matter of claim 1 does not involve an inventive step in the sense of Article 33(3) PCT.

- 3 Dependent claims 2-4,6 and 10-21 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step. It is believed that the subject-matter of these claims is explicitly disclosed by the documents D1 and D4 in combination.
- 3.1 Additionally the subject-matter of dependent claims 5 and 7-9 is also known in the state of the art as indicated by documents D5 (see fig. 2 of D5).
- 4 The invention is industrially applicable in the field of gas turbine engines (Art. 33(4) PCT).

Re Item VII

Certain defects in the international application

- 1 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in document D4 is not mentioned in the description, nor is this document

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/EP2005/050804

identified therein.

Re Item VIII

Certain observations on the international application

- 1 Under Art. 6 PCT the following objections are made against the application:
 - 1.1 Independent claim 1 is introduced as a component defining one of a blade and a vane for a rotary machine. It is unclear how a component can be a blade and a vane at the same time. The expression "and" should have been replaced by "or" in order to avoid this unclarity taking into account that such a clarification would not limit the intended scope of protection.
 - 1.2 Claims 1,4,6,11 and 12 do not only define the component per se but also specify its relationship to further entities which are a rotary machine and a rotor and which do not form part of the subject-matter of the respective claims. Secondly, claims 4,6,11 and 12 attempt to define the subject-matter in terms of the result to be achieved.

Claims

1. A component defining one of a blade and a vane for a rotary machine having a rotor (2), which is rotatable about a rotary axis (x), the component comprising
5 an inner space (10), which is limited by first wall (11) and a second wall (12) facing each other and which has an inlet (17) and an outlet (18), wherein the inner space (10) forms a passage for a cooling fluid from the inlet (17) to the outlet
10 (18),
at least first ribs (21), projecting from the first wall (11) and extending substantially in parallel to each other to form first channels (23) for the fluid from a leading end of the first ribs (21) to a trailing end of the first ribs (21), and
15 second ribs (22), projecting from the second wall (12) and forming second channels (24) for the fluid from the leading end of the second ribs (22) to the trailing end of the second ribs (22),
wherein the first ribs (21) and the second ribs (22) intersect
20 each other and are directly connected to each other at said intersections,
wherein the first and second ribs (21, 22) intersect at intersection joints (26) in the proximity of the trailing end in such a way that the first channels (23) and the second
25 channels (22) form common outlet channels (27) with flow areas, characterised in that each such common outlet channel includes means for providing a reduction of the flow area in the proximity trailing end,
wherein the first and second ribs (21, 22) have a main thickness (b) along their extension, wherein the first and second ribs (21, 22) at the intersection joints (26) have a thickness being larger than the main thickness, thereby providing
30 said reduction of the flow area of the common channels (27).
35 2. A component according to claim 1, characterised in that each of the common outlet channels has a height (H) measured from the first wall (11) to the second wall (12), wherein each of the first channel (23) and second channel (24) has a

height (h) extending from the first wall (11) and second walls (12), respectively, to the second ribs (22) and first ribs (21), respectively.

5 3. A component according to claim 1 or 2, characterised in that the first ribs (21) extends in parallel to each other and that the second ribs (22) extends in parallel to each other.

10 4. A component according to claim 3, characterised in that the first ribs (21) extend from the leading end to the trailing end along a first direction in the proximity of the leading end and along a second direction in the proximity of the trailing end, wherein the first direction is inclined in relation to the second direction and wherein the component is adapted to be mounted to the rotor (2) in such a way that the first direction forms a first angle (α) of inclination to the rotary axis (x).

15 5. A component according to claim 4, characterised in that the first ribs (21) extend from the leading end to the trailing end along a substantially continuously curved path.

20 6. A component according to any one of claims 4 and 5, characterised in that the second ribs (22) extend from the leading end to the trailing along a third direction in the proximity of the leading end and along a fourth direction in the proximity of the trailing end, wherein the third direction is inclined in relation to the fourth direction and wherein the component is adapted to be mounted to the rotor (2) in such a way that the third direction forms a third angle (β) of inclination to the rotary axis (x).

25 7. A component according to claim 6, characterised in that the second ribs (22) extend from the leading end to the trailing end along a substantially continuously curved path.

8. A component according to any one of claims 6 and 7, characterised in that the second direction is substantially parallel the fourth direction.
- 5 9. A component according to any one of claims 6 to 8, characterised in that the second direction and the fourth direction are substantially parallel to the rotary axis (x).
- 10 10. A component according to any one of claims 6 to 9, characterised in that the first direction intersects with the third direction.
- 15 11. A component according to any one of claims 6 to 10, characterised in that the component is adapted to be mounted to the rotor (2) in such a way that the third direction slopes from the leading end towards the rotary axis (x).
- 20 12. A component according to any one of claims 4 to 11, characterised in that the component is adapted to be mounted to the rotor (2) in such a way that the first direction slopes from the leading end away from the rotary axis (x).
- 25 13. A component according to any one of the preceding claims, characterised in that the component is adapted to be mounted to the rotor (2) in such a way that the first ribs (21) are provided on a pressure side of the component and that the second ribs (22) are provided on a suction side of the component.
- 30 14. A component according to any one of the preceding claims, characterised in that the first and second ribs (21, 22) extend over a leading zone (35) extending from the leading end and a trailing zone (36) extending from the trailing end.
- 35 15. A component according to claim 14, characterised in that the component includes additional first ribs (21') projecting from the first wall (11) and extending substantially in par-

allel to each other over the trailing zone (36) to the trailing end, wherein the additional first ribs (21') extend in parallel with the first ribs (21) in such a way that substantially every additional first rib (21') is provided between two respective adjacent first ribs (21), thereby dividing substantially every one of the first channels (23) into two parallel part channels (23') extending over the trailing zone (36).

10 16. A component according to claim 15, characterised in that the component includes additional second ribs (22') projecting from the second wall (12) and extending substantially in parallel to each other over the trailing zone (36) to the trailing end, wherein the additional second ribs (22') extend in parallel with the second ribs (22) in such a way that substantially every additional second rib (22') is provided between two respective adjacent second ribs, thereby dividing substantially every one of the second channels (24) into two parallel part channels (24') extending over the trailing zone
15 (36).

20 17. A component according to claim 16, characterised in that the additional first and second ribs (21', 22') intersect at an intersection joint (26') in the proximity of the trailing end in such a way that each of the part channels (23') from the first channels (23) together with one of the part channels (24') from the second channels (24) form a common outlet channel (27') with a flow area.

30 18. A component according to claim 17, characterised in that the additional first and second ribs (21', 22') have a main thickness along their extension, wherein the additional first and second ribs (21', 22') at the intersection joint (26') have a thickness being larger than the main thickness,
35 thereby providing a reduction of the flow area of the common channels (27').

19. A component according to any one of the preceding claims, characterised in that the inner space (x) extends along a centre axis (y) of the component from a bottom portion (16) adjacent the inlet (17) to an opposite top portion 5 (15).

20. A component according to any one of the preceding claims, characterised in that the inner space (10) downstream the inlet (17) and upstream the leading end of the ribs includes a distribution chamber (19) adapted to distribute the cooling fluid from the inlet (17) to substantially all of the channels. 10

21. A component according to claims 19 and 20, characterised in that the distribution chamber (10) extends from the bottom portion (16) to the top portion (15). 15